NASA TECHNICAL TRANSLATION

N74-10782

NASA TT F-15,162

MARS SPACECRAFT ON A SUPER LONG JOURNEY

L. Vesnyankin

Translation of: "(Marsy) na Sverkhdal'nem Marshe," Gudok, September 18, 1973, p. 4.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D. C. 20546 NOVEMBER 1973

STANDARD TITLE PAGE

1. Report No. NASA TT F-15,162	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle MARS SPACECRAFT ON A SUPER LONG JOURNEY		5. Report Date NOVEMBER 1973 6. Performing Organization Code
7. Author(s) L. Vesnyankin		8. Performing Organization Report No. 10. Work Unit No.
9. Performing Organization Name and Address Techtran Corporation P.O. Box 729 Glen Burnie, Maryland 21061		11. Contract or Grant No. NASw-2485 13. Type of Report and Period Covered Translation
12. Sponsoring Agency Name and Address NATIONAL AERONAUTICS AND SPACE ADMINISTRATION WASHINGTON, D.C. 20546		14. Sponsoring Agency Code

15. Supplementary Notes

Translation of: "(Marsy) na Sverkhdal'nem Marshe," Gudok, September 18, 1973, p. 4.

16. Abstract

A popularly written sketch of the various Mars probes of different countries.

17. Key Words (Selected by Author(s))	18. Distribution Statement
	Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	5	

NASA-HQ

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Four stations, the "Mars-4", "Mars-5", "Mars-6", and the "Mars-7" are flying /4* toward Mars. This is an entire interplanetary flotilla. In fact, always, one strives to send multiple stations out when it is convenient. The fact of the matter is that the scientific apparatus aboard the spacecraft is extremely varied. During such flights a great deal is studied: solar flares, cosmic rays, gravitational and magnetic fields, micrometeorites. This is without even mentioning the planets themselves. Therefore aboard the stations attempts are made to install as many instruments as possible: photometers, spectrometers, radiometers, etc. The limited capacities (dimensions of the stations) frequently do not permit all of these to be placed aboard a single craft. Then "doubles" appear. During this process, the instruments are placed aboard the spacecraft such that information obtained from each of them fills out the overall picture, and most importantly, such that the picture will be more reliable. In fact when the results of measurements come over a radio channel a distance of millions of kilometers, prior to receiving them on the Earth breakdowns and errors are possible.

There have been doubles before. One recalls the automatic interplanetary stations, "Venus-5", "Venus-6", "Mariner-6", and "Mariner-7". The latter two investigated various regions of Mars: "Mars-2" and "Mars-3" were in different orbits around the planet.

The missions of the spacecraft flying to meet the red planet also differ. Correspondingly, there is also a certain difference in the combinations of instruments installed aboard them. "Mars-6" and "Mars-7" have installed aboard, for example, French instruments which investigate the radio irradiation of the Sun in the meter wave band.

This year the "window" for possible launches to Mars was a broad one — nearly a month long. This permitted the accomplishment of complex

*Numbers in the margin indicate pagination in the foreign text.

operations in preparing and launching an unparalleled large number of interplanetary automatic stations.

There are four beacon stars in the sky, which are, truly, "observable" only in the radio range. With their rising, the vast dishes of the Center for Long Range Space Communications are aimed at the sky. Intensive work is going forward in verifying the trajectory of spacecraft, and the condition of their onboard systems is being analyzed. The green "flashes" on the screens of the oscillographs flash gaily — steady signals are coming in from space.

This speechless "conversation" will continue for a long time. Only in March, 1974, will the spacecraft reach their target. By then, they will have hundreds of millions of kilometers behind their "shoulders."

The stations long flight in world space does not in any way signify the idle waiting for the finish: on the Earth many specialists are working under great pressure — those who receive the first information and those who process it, those who make calculations, formulate flight plans, and those who send the guidance radio commands over the great distances... Vast computer centers carry out calculations for correction — corrections to trajectories which are necessary over so long a "flight." The correction maneuver is a complex operation which includes sending the data of calculations for "onboard use", "remembering" them, making turns to the necessary attitude by the aid of sensitive optical sensors and gyroscopes, turning on and turning off the onboard engine (exactly at the proper moments), and finally, "transmitting" telemetric information — the "consideration" of work accomplished.

The communications session (and there are many tens of these which each station!) — is millions of units of information in both directions along a gigantic radio bridge. We shall take only telemetry for an example. The specialists are interested in everything: current level of solar batteries, whether or not pressure has fallen in the tanks of the onboard engine, how many degrees of temperature there are in the sealed areas, whether or not the optical sensor is fixed on the Sun...

It would seem that not much is necessary in order to guide the apparatus through "emptiness" which separates the planet. However the so-called "support"

systems occupy a dominant position in the makeup of the spacecraft. One of these is directly related to the effect of the environment. This is the temperature regulating system. The spacecraft, during its flight, becomes more and more remote from the Sun, but the internal temperature of the sealed area remains constant, it is kept so by a cleverly organized circulation of gas in the instrument compartment.

But this is, as they say, "active" work. The system also contains "passive" elements: the muffling "coat" of the screening-vacuum insulation, and special covers.

The panels of the solar batteries constantly "look" at the Sun, ensuring full charging of the batteries. In this they are aided by a complex laser instrument set – the guidance system. There are no simple instruments and aggregates here: the solar and stellar sensors of orientation, the gas jets for turns, the stabilizing gyroscopes, and the onboard digital computers. But then the guidance system "is capable" of a great deal – of orienting the onboard beam directed radio antenna at the Earth, of carrying out the previously described complex correction maneuver, and many other things.

Without communication with the Earth the flight would be unthinkable. "A conversation" is carried out with the station in many "languages." In the "language" of trajectory measurements... In the "language" of telemetric data concerning the condition of the onboard systems... In the "language" of scientific information...

When the duty operator at the flight control center brings the powerful "space organ" into action, the varicolored flames of the huge screens of the coordinating computer center flash into life. Both centers work in a strictly coordinated fashion.

I was at the coordinating computer center at one of these sessions – the corrections session. The time has long since passed when turning on an engine in space – one far from Earth – has been considered a great event. Today the operators of the analysis group report on the fact of correction as if reporting on something mundane. And in a dry monologue, giving information on the values of angles of turn and pressure in the tanks for fuel supply to the engine, one

somehow does not immediately sense the grandiose work of thousands of specialists who have learned in error-free fashion to guide interplanetary expresses along super long routes.

I examined the summary data. The columns of figures of "duty parameters" can be brought to a single comprehensible denominator — onboard all "spacecraft" everything is normal. The spacecraft pass beyond the horizon — this means rest for the tensely working people who now live by their "space" time.

Translated for the National Aeronautics and Space Administration under Contract No. NASw-2485 by Techtran Corporation, P. O. Box 729, Glen Burnie, Maryland, 21061; translator, Samuel D. Blalock, Jr.